Remarks/Arguments

Claims 1-41 are in the application. Claims 1, 15, 21, 27, and 34 are in independent form. Claims 1-5 and 11-41 are rejected. Claims 6-10 are objected to as being dependent upon a rejected base claims, but would be allowable if rewritten into independent form. Applicants that the Examiner for the indication of allowable subject matter.

Claims 24-26 are amended to correct dependencies.

Claim Rejections - 35 USC § 103

Claims 1-5, 11, 13-17, 20-26, 34-37, and 41 stand rejected under 35 USC 103(a) for obviousness over Chin Li Cheung et al., "Carbon Nanotube Atomic Force Microscopy Tips: Direct Growth by Chemical Vapor Deposition and Application to High Resolution Imaging," PNAS, vol. 97; no 8, pp 3809-3813 (2000) ("Cheung") in view of Z.F. Ren et al., "Growth of a Single Freestanding Multiwall Carbon Nanotube On Each Nanonickel Dot," Applied Physics Letters, vol. 75; no. 8, pp 1086-1088 (1999) ("Ren").

Claim 1 recites "directing a charged particle beam activated gaseous material toward said surface of said probe tip support member" and "scanning a charged particle beam over said surface, the charged particle beam inducing a reaction with the charged particle beam activated gas to deposit a catalyst layer, said catalyst layer comprising a material capable of catalyzing the growth of a nanotube." The references do not teach the use of charged particle beam deposition to deposit a catalyst to grow a nanotube.

Applicants' specification provides an example of charged particle beam deposition in paragraph [1049]. A beam activated precursor gas, such as a nickel acetyl acetonate gas, is decomposed by an electron beam into nickel, which is deposited, and volatile compounds, which are pumped away. Because the metal is deposited only in areas to which the beam is directed, the beam directly "writes" the metal at the desired location.

The Examiner states that Ren teaches the use of a particle-beam grown nickel catalyzing layer.. Applicants submit that Ren teaches a "standard microlithographic process" process (Ren Abstract), not a charged particle beam deposition process. While Ren uses charged particle

beams in two steps of his lithography process, Ren does not direct a charged particle beam activated gaseous material toward the surface and does not use a charged particle beam to induce a reaction with a charged particle beam activated gas to deposit a catalyst layer.

In Ren's lithography process, an electron beam resist material is applied to cover the substrate. The resist material is exposed to a patterning electron beam. Page 1086, para. 3. The pattern traced by the electron beam alters the resist, thereby determining which portions of the resist will be removed in the developing step. The developing step removes some of the resist, leaving a pattern of resist partially covering the surface. Thus, the electron beam is not to activate a gas to deposit a catalyst.

Ren then applies a nickel film to the entire surface using electron beam evaporation. Page 1086, para. 3. In electron beam evaporation, a nickel source is heated by the electron beam until nickel evaporates and deposits indiscriminately. (P. Van Zant, Microchip Fabrication, defines "evaporation" as "A process step that uses heat to change a material (usually a metal or metal alloy) from its solid state to gaseous state with the result of the source being deposited on wafers. Both electron beam and filament evaporation are common in semiconductor processing." Page 618.) In electron beam evaporation, the electron beam does not induce a reaction with a "charged particle beam activated gas to deposit a catalyst layer;" the electron beam supplies energy to evaporate the source metal.

The evaporation process coats the entire substrate with metal, with some of the metal deposited on top of the patterned photoresist and some of the metal deposited directly on the substrate. The substrate is washed with acetone, which removes the remaining photoresist, along with the nickel that was deposited on the photoresist, leaving only nickel that was deposited directly on the substrate where the photoresist was removed prior to the nickel deposition. Page 1086, para. 3.

Thus, Cheung and Ren do not teach the elements of claim 1. Moreover, the microlithographic method of Ren is used for the production of an array of nanoparticles. Page 1086, para 1. Applicants submit that there is no motivation to combine a lithographic method suitable for producing an array of nanotubes on a relatively large surface with Cheung that produces nanotubes on a probe support.

Regarding claim 4, which recites that a "catalyst layer has a substantially planar surface which is not parallel to the planar surface of said probe tip support member," applicants submit that this element is not taught in the references. Cheung deposits a catalyst in a hole and there is no indication that the catalyst layer has a substantially planar surface that is not parallel to the planar surface of said probe tip support member. The Examiner cites Cheung's FIG. 2a to show that: "The probe distal surface appears slanted (non-parallel to the base of the cone)." FIG. 2a shows multi-walled nanotube tubes grown by a CVD process. While the end of the tip itself, which is composed of plural multiwalled nanotubes, is not perfectly even, there is no indication that the catalyst layer surface on which the tip is grown not parallel to the tip support surface. In fact, Cheung states that: "Growth of MWNTs [multi-walled nano tubes] from a porous substrate by CVD results in nanotubes oriented perpendicular to the substrate plane (24)." P. 3810, col. 2, last paragraph.

Moreover, the lithographic process of Ren is not suited to produce a layer that is "not parallel to the planar surface of said probe tip support member." Claim 22 includes limitations similar to that of claim 4.

Claim 23 recites "said support having a longitudinal axis running from the shaped tip through the center of the support and wherein the surface of the planar end is not perpendicular to the longitudinal axis." For example, claim 23 could describe a cone-shaped support that is truncated at an angle to produce an angled surface on the end of the support. The nanotube, which grows perpendicular to the angled surface, is then at an angle to the longitudinal axis of the support probe. This is not shown in the cited references.

Claims 34 recites cutting a tapering probe tip support member to provide a planar surface that is of a desired size and that is not perpendicular to the longitudinal axis. As described above with respect to claim 23, this element is also not taught by the references.

Claim Rejections - 35 USC § 102

Claims 27-30 stand rejected under 35 USC § 102 as anticipated by U.S. Pat. No. 5,824,470 to Baldeschweiler. ("Baldeschweiler"). A claim is anticipated only if each and every

element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. MPEP 2131.

Claim 27 recites "said probe tip support member formed by flattening an end of a tapering probe tip support member using charged particle beam milling in order to provide a substantially planar surface of a particular size." The Examiner cites Baldeschweiler col. 4, lines 30-38, in which Baldeschweiler mentions ion milling. Baldeschweiler, however, mentions ion milling in regard to <u>sharpening</u> a <u>tip</u> (col. 4, line 33-34), not with regard to flattening an end of a tapering tip support to provide a substantially planar surface of a particular size.

Baldeschweiler appears to produce a sharp tip, and then either activates a small area of tip towards functionalization or passivates most of the tip while protecting a small area from passivation, and then attaches a macro molecule at the small activated or unpassivated area. Col. 12, lines 33-62. Baldeschweiler does not teach charged particle beam milling a tapered tip support "in order to provide a substantially planar surface of a particular size." By using a tapered support, one can chose the size of the planar surface by controlling where along the taper the cut is made.

Double Patenting Rejections

Claims 1-5 and 11-41 are rejected for obviousness-type double patenting. Applicants submit a terminal disclaimer to overcome the obviousness-type double patenting rejection.

Applicants submit reconsideration of the rejection and allowance of the application.

Respectfully submitted,

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element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. MPEP 2131.

Claim 27 recites "said probe tip support member formed by flattening an end of a tapering probe tip support member using charged particle beam milling in order to provide a substantially planar surface of a particular size." The Examiner cites Baldeschweiler col. 4, lines 30-38, in which Baldeschweiler mentions ion milling. Baldeschweiler, however, mentions ion milling in regard to sharpening a tip (col. 4, line 33-34), not with regard to flattening an end of a tapering tip support to provide a substantially planar surface of a particular size.

Baldeschweiler appears to produce a sharp tip, and then either activates a small area of tip towards functionalization or passivates most of the tip while protecting a small area from passivation, and then attaches a macro molecule at the small activated or unpassivated area. Col. 12, lines 33-62. Baldeschweiler does not teach charged particle beam milling a tapered tip support "in order to provide a substantially planar surface of a particular size." By using a tapered support, one can chose the size of the planar surface by controlling where along the taper the cut is made.

Double Patenting Rejections

Claims 1-5 and 11-41 are rejected for obviousness-type double patenting. Applicants submit a terminal disclaimer and the fee under 37 CFR 1.20(d) to overcome the obviousness-type double patenting rejection.

Applicants submit reconsideration of the rejection and allowance of the application.

Respectfully submitted,

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